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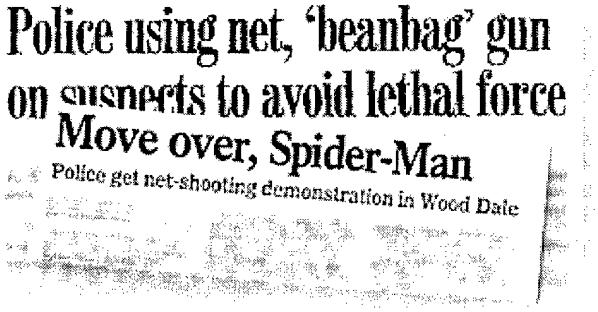
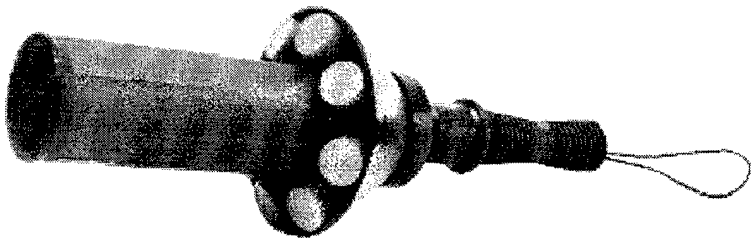
Officer Hand Launcher: OHL5 Overview

- Designed and manufactured in Leipzig, Germany by GETEC GmbH
- Complete range of Net Launchers for every application
- Used against felons, intruders, fugitives, assailants, animals
- In use across the United States by Police Departments and Emergency Response Teams
- Provides a true non lethal response to aggression while severely restricting movement to facilitate arrest


Police using net, 'beanbag' gun on suspects to avoid lethal force
Move over, Spider-Man
Police get net-shooting demonstration in Wood Dale



Law Enforcement Agencies have come under enormous pressure in the past few years to move away from traditional armed response against fugitives and employ a variety of new less than lethal weapons.

Less than lethal includes chemical sprays and electrocution in many imaginative forms. Soft projectiles can incorporate more chemicals to disorient and impair the target, or simply cause tissue damage to subdue aggressive actions. Much has been written about sticky foams and other devices that might be more at home on a movie set, and are yet to find their way into the commercial market.

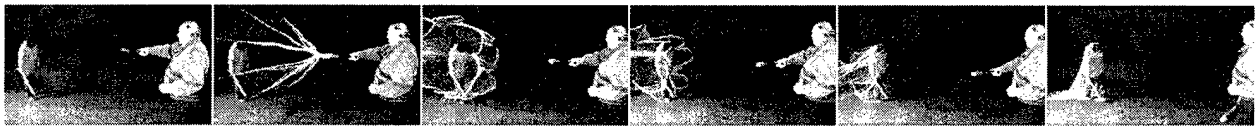
The Officer Hand Launchers by GETEC provide Law Enforcement Personnel with the opportunity to significantly restrict the target's movement and facilitate arrest without relying on unpredictable and dangerous reactions to noxious chemicals, projectiles or electrocution.

Officer Hand Launchers are now in use across North America and around the world. Police Emergency Response Teams have used OHL5s in the field to successfully confront and arrest subjects who did not react to chemical deterrents and other measures. Departments are now moving from an ERT-only application to more general use by Officers.

The OHL5 is just one of a complete family of Hand Launchers designed to meet specific applications. New models are being developed throughout 1998 and will be introduced on our internet web site at www.getec.com as they become available.

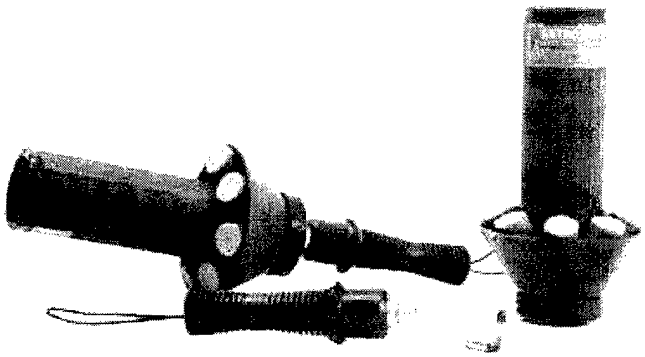
OHL5 SPECIFICATIONS

- **LAUNCH READY**
  870 GRAMS
  395 MM LENGTH
  130 MM MAX WIDTH
- **CAPTURE NET**
  5.0 X 5.0 M
  70 X 70 MM MESH
  140 NEWTON TEAR
- **PROPELLANT**
  9 MM
  CO2 CHARGE
  PLASTIC BLANK
- **PERFORMANCE**
  170 KPH LAUNCH
  2 METERS<7.5 JOULE
  2.0 M MIN RANGE
  5.0 M MAX RANGE
  2.5 M EXPANSION

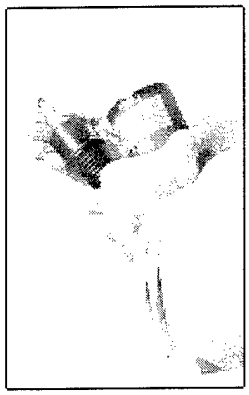


Officer Hand Launcher: OHL5 Operation

- Three components make up a complete OHL5.
- The Hand Launcher is reusable and contains the firing mechanism to launch the Net. It weighs 220 grams and is 170 mm long.



- Gas Cartridges manufactured by Dynamit Nobel provide the propellant and are inserted into the Hand Launcher. They are 9 mm plastic blank cartridges containing carbon dioxide and a propellant powder (single-base with a low portion of nitroglycerin). Consult the Material Data Safety Sheet for additional information.
- The Net Cannon is 130 mm by 225 mm and weighs 650 grams. The Cannon contains the 5 x 5 meter Net which launches at 170 kph. Eight external lead expansion weights covered in protective polystyrene foam open the Net to a 2.5 x 2.5 meter window, enveloping the target in less than one second. The Nets are manufactured from an advanced thread, selected for high tear strength and light weight. A tight mesh of only 70 square mm restricts hand movement through the net, and the captive is easily controlled and handcuffed.



- Operation of the OHL5 is a simple procedure for any professional trained in the use of firearms.
- Insert the Gas Cartridge into the small chamber at the top of the Hand Launcher.
- Align the threads on the Hand Launcher and Net Cannon and twist one against the other approximately 270 degrees or until a snug fit is reached.
- To ready the OHL5 for firing, hold the Hand Launcher in one hand and lightly pull back on the trigger cord. This action engages the firing pin, which is activated by pulling back the trigger ring at the top of the Hand Launcher with the thumb or two fingers.

- Note that a safety position is available on the trigger ring, which is reached by rotating the trigger to the right.
- When aiming and firing the OHL5, a clear window of deployment must be calculated to determine the trajectory of the Net. Obstacles such as tree branches and furniture will upset the path of the Net. Aiming the OHL5 in the manner of a flashlight, target the chest area at no less than 2.0 meters to no more than 4.5 meters for optimum effect.
- The Net and Expansion Weights should not pose a significant impact danger to the target. Note that injury to soft tissue such as the eyes can occur with any projectile including those products made by GETEC.
- Only those professionally trained in the proper use and deployment of firearms and security products should use GETEC products.

GETEC® GmbH Leipzig designs and develops security systems and defense products for a wide range of consumer and government needs. GETEC products have received numerous international patents for their design and unique technology. Access to a worldwide network of distributors and additional information on GETEC is available at www.getec.com.

To find out more about GETEC products, contact **Michael Wolf** at Getec America Corporation in Seattle. Our address is 1420 5th Avenue, Suite 2200, Seattle WA 98101 and the numbers are 206.224.7607 (b) and 206.224.2880 (f).

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GETEC in the media: 10.07.97

Baltimore Sun 9/30/97

Baltimore police have a new weapon to help subdue dangerous people without shooting them.

In addition to a 'beanbag' gun used to disable armed suspects that was used for the first time last month, the Police Department now has a (268 sq ft) net to cast over suspects.

It's not quite Spiderman shooting a web from his wrist, but **officers used the device for the first time last week to capture a distraught woman who was reaching for a butcher's knife.**

"We were happy with the result," said Maj. Bert L. Shirley, commander of the tactical section. "We're still experimenting with it to see what situations it can be used in, but we prefer this to deadly force."

The device is a small cylinder that resembles a wand. An officer aims it and presses a button. The folded net is ejected and spreads over the target. It has a range of 15 to 18 feet.

The issue of less-lethal force was highlighted after a controversial shooting Aug. 9 outside Lexington Market in West Baltimore. As a bystander videotaped the confrontation, Officer Charles M. Smothers II fatally shot James Quarles, 22, after Quarles refused to obey repeated demands to drop a knife. Smothers was cleared of criminal responsibility but faces an internal review.

One of the issues police are studying in the six-minute confrontation in the Quarles case was whether police had time to call tactical officers, who are the only officers who have the 'beanbag' gun – which fires a bag of lead pellets – and the net. Both devices were acquired before the shooting.

In the most recent case, police said they responded Friday to a report of a 60-year-old mentally ill woman who had assaulted her apartment building manager and barricaded herself in a room in the 1400 block of N. Carey St. in West Baltimore.

Tactical officers forced their way into the building and sprayed the woman with tear gas as she went to a kitchen. Police say the chemical spray had no effect.

Police fired the net as the woman ran to a back bedroom with her hands in her purse. Police said that after the woman was subdued, they found a butcher's knife in her purse. The woman was not charged but taken to a hospital for a psychiatric evaluation.

Police using net, 'beanbag' gun on suspects to avoid lethal force

By Peter Hermann
SUN STAFF

Baltimore police have a new weapon to help subdue dangerous people without shooting them.

In addition to a "beanbag" gun used to disable armed suspects that was used for the first time last month, the Police Department now has a 12-foot-square net to cast over suspects.

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Baltimore Police Department Incident Sheet

TACTICAL OPERATIONS EMERGENCY TRUCK	INCIDENT SHEET
TYPE OF INCIDENT: VIOLENT MENTAL CASE	DATE/TIME: 26 SEPT 97 1100 HRS
LOCATION: 1431 N. CAREY APT. 306	COMPLAINT: 7118301

NOTIFIED BY KGA TO RESPOND TO 1431 N CAREY FOR A VIOLENT 10-31 MENTAL. UPON ARRIVAL 7811 ADVISED THAT A 60 YR OLD FEMALE, WITH A HISTORY OF MENTAL ILLNESS HAD ASSAULTED THE BUILDING MANAGER, AND THEN BARRICADED THE APARTMENT DOOR. WE USED A HYDRAULIC TOOL TO ENTER, OBSERVED SUBJECT ATTEMPTING TO ENTER KITCHEN, UNABLE TO SEE HANDS OF SUBJECT, I USED FOAM MACE. SUBJECT ATTEMPTED TO RUN INTO REAR BEDROOM, ATTEMPTING TO GET HAND IN PURSE, I THEN ACTIVATED THE HAND HELD NET. **SUBJECT WAS TAKEN DOWN WITH USE OF NET**, AND SUBDUED. INSIDE PURSE WAS A 8" BUTCHER KNIFE. NO INJURIES TO SUBJECT AND POLICE OFFICERS.

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GETEC in the media: 07.24.97

Chicago Daily Herald 7/24/97

Schaumburg police officer Dennis Ca... right, gets tangled up Thursday in ... police Sgt. Jim Doherty, left, tries to demonstrate on the Wood Dale Poli...

Move over, Spider-Man

Police get net-shooting demonstration in Wood Dale

The Shocker and his villainous cohort Venom prove no match for Spider-Man's spinning webs.

Although the fictional Peter Parker won't be swinging from Wood Dale buildings anytime soon, residents can sleep well at night knowing their town has the next best thing.

The Wood Dale Police Department is the first cop shop in the area to test a net-shooting device that promises to trap bad guys in a tangled web of confusion.

"Officer Hand Launcher" made its debut Thursday outside the police station as the product's marketers held a demonstration for officials and police from Des Plaines, Elk Grove Village, Elmhurst, Rosemont and Schaumburg.

"We're always looking for different ways to contain a person while using the lowest level of violence possible," Wood Dale Cmdr. Frank Biniewicz said. "It's a very effective and non-combative way of neutralizing a person."

An officer aims a flashlight-looking device that weighs only two pounds at the suspect. He or she triggers a cartridge that launches a 268-square-foot net over the target.

The net travels at about (100 miles per hour), though it only will trap a target up to 15 feet away. The nets are made from an advanced thread and aren't easily torn or sliced and further entangle suspects as they try to break free.

Bensenville-based New Millennium Products plans on marketing the launcher across the state. So far, it's mainly used by federal armed forces and special groups including a Seattle SWAT team.

It gives police another option in detaining fugitives or suspects causing harm to others rather than using force, a nightstick or even a gun.

"If you look at all the publicity in the news these days, there's a lot of police being accused of using too much power or in beatings," said Itasca resident Craig Carone, part-owner of the company (New Millennium Products).

"This not only protects the officer and the suspect, but it protects the department and taxpayers from a lawsuit."

For hosting the demonstration, Wood Dale received a launcher, net cannon and gas cartridge worth almost $300. The launcher is reusable, but each net costs $158. The department plans on training its sergeants and possibly purchasing more equipment if officials find it works.

LASER DAZZLER

9/30/97

LE Systems has developed a new tool, for today's Law Enforcement, Corrections & Military Communities. Under the sponsorship of DARPA's Joint Program Steering Group, LE Systems has completed and delivered, ten prototype non-lethal laser flashlights. The Laser Dazzler is designed to allow the officer to "reach out" to their suspect.

Working with both Phillips Laboratory, [PL/LIDA], and the National Institutes of Justice, [NIJ], the design incorporates features which allows the officer to disorient, confuse, and distract the suspect, without causing bodily harm.

Eyesafe at the aperture, the Laser Dazzler will have a temporary effect on the officers adversary. It presents to the target, an "optical wall", which will cause most suspects to turn away from the light. Another feature of the flashlight is the "strobe" effect, built into the programmable power supply, which modulates the laser, to add to the distraction.

During the course of the devices development, LE Systems has interacted with numerous potential endusers. Comments have ranged from, "how soon can I have one?", to, "if only we had this yesterday"

Today's Police Officer, Corrections Officer or Soldier in peace-keeping efforts, has many choices when dealing with a potentially violent situation. Unfortunately, with these choices come limitations. Traditional tools such as batons, pepper sprays and defensive tactics require the Officer to place him or herself within close personal distances with their adversary, which greatly increases the chance of injury. Less-Lethal munitions (Bean Bag, Baton, & Net rounds) allow only a slightly greater distance, but can (and have) caused unwarranted lethal injuries. These devices often escalate encounters because of the close proximity the operators must get have with their targets. Firearms bring a tragic end to some situations where no other means are available to safely control an individual from distance.

Distance is the key to controlling potentially violent encounters. Creating a safety zone for the officers involved and a time cushion to allow a variety of decisions on the use of force continuum does this. Having a Laser Dazzler, in the inventory, will give the officer the ability to reach out beyond 25 meters, to ranges up to hundreds of meters. The Laser Dazzler will give the officer or soldier an "optical shield", even in daylight, and will give the officer a choice, an upper hand, and most of all time, before resorting to lethal force.
LE Systems Inc. expects to be able to begin, "limited", deliveries of the Laser Dazzler by the end of 1998, to selected endusers. The initial device incorporates, "off-the-shelf" technology, and the second generation will be "smaller, lighter, and less expensive".

Keywords: Laser, Non-Lethal, Dazzle, 532nm, and Eyesafe

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For further information contact: Richard Nelson, Program Manager - Laser Systems

Laser Dazzler for Non-Lethal Force Applications

LE Systems has developed a new tool, for today's Law Enforcement, Corrections & Military Communities. Under the sponsorship of DARPA's Joint Program Steering Group, LE Systems has completed and delivered ten prototype non-lethal laser flashlights. The Laser Dazzler is designed to allow the officer to "reach out" to their suspect.

Working with Phillips Laboratory, [PL/LIDAI, and the National Institutes of Justice, NIJ, the design incorporates *features,* which allows *the* officer to disorient, confuse, and distract the suspect, without causing bodily harm.

The Laser Dazzler is essentially a handheld, green, 532mn diode pumped laser. The *532nm* frequency was chosen for it's unique ability to react with the human eye in both daylight and reduced light conditions, causing disorientation and confusion. The second advantage is the range of green light is, "orders of magnitude" greater than white light

Eyesafe at the aperture, the Laser Dazzler will have a temporary effect on the officer' or soldier's 5 adversary. It presents to the target, an "optical wall", which will cause most suspects to turn away from the light. *Although a minimal* use of force, the Laser Dazzler gives the user a "time cushion" that is found in no other device. This "time cushion" allows a safe standoff distance, greater officer safety, surrender, de-escalation, or other force options to be exercised. Another feature of the flashlight is the "strobe" effect, built into the programmable power supply, which modulates the laser, to add to the distraction I disorientation effects.

In encounters between law enforcement personnel and persons demonstrating passive resistance or emotionally disturbed individuals, the distance between the two can be directly related to force needed to control the individual and the potential for violence. With conventional tools currently available to law enforcement, the officer must get within close personal distances to employ any non-lethal measures. Closing this distance increases the risk to the officer and to the escalation of the event. Less-lethal measures can increase the standoff distance to approximately *25* meters, but the potential for injury or even death is real.

Non-Lethal devices, such as the Laser Dazzler, are not meant to replace anything tools currently used in law enforcement. They are to add to the versatility of law enforcement, dealing in today's litigious world. The goal of non-lethal devices is greatly different from less-lethal devices. Non-lethal devices offer temporary control, their effects are uncomfortable, they cause no injury, and there are no lawyers. Less-Lethal devices offer a higher level of control, but the potential for injury or death must be carefully weighed before use.

The Laser Dazzler, in its current configuration, can be effectively used beyond distances of fifty meters. This allows for a large "time cushion", enhanced officer safety, and a tremendous effect referred to as a "Psychological Takedown". This is the ability to effectively interact with a subject, by overwhelming the senses without injuring, and without getting within close personal distances.

The Physical design of the Laser Dazzler is critical. This device is designed to look like and be operated like a typical law enforcement flashlight. This is to maintain a consistency in training with the officer. All of the physical skills needed to utilize the Laser Dazzler, as a stand-alone device or in conjunction with a duty firearm, are the same as those currently used with a flashlight. (Figure 1)

The mechanical design of the Laser Dazzler is very straightforward. The assembly consists of four subassemblies. The "Patent Pending" LE System resonator, a four cell rechargeable battery pack, computer controlled power supply, and the Beam Expander assembly. Each subassembly is modular, allowing for independent assembly, and computerized testing prior to final assembly.

LE Systems inc. expects to be able to begin, "limited", deliveries of the Laser Dazzler by the end of 1998, to selected end users. The initial device incorporates, "off-the-shelf' technology, and ~e second generation will be "smaller, lighter, and less expensive

Keywords: Laser, Non-Lethal, Dazzle, $532nm_3$ and Eyesafe

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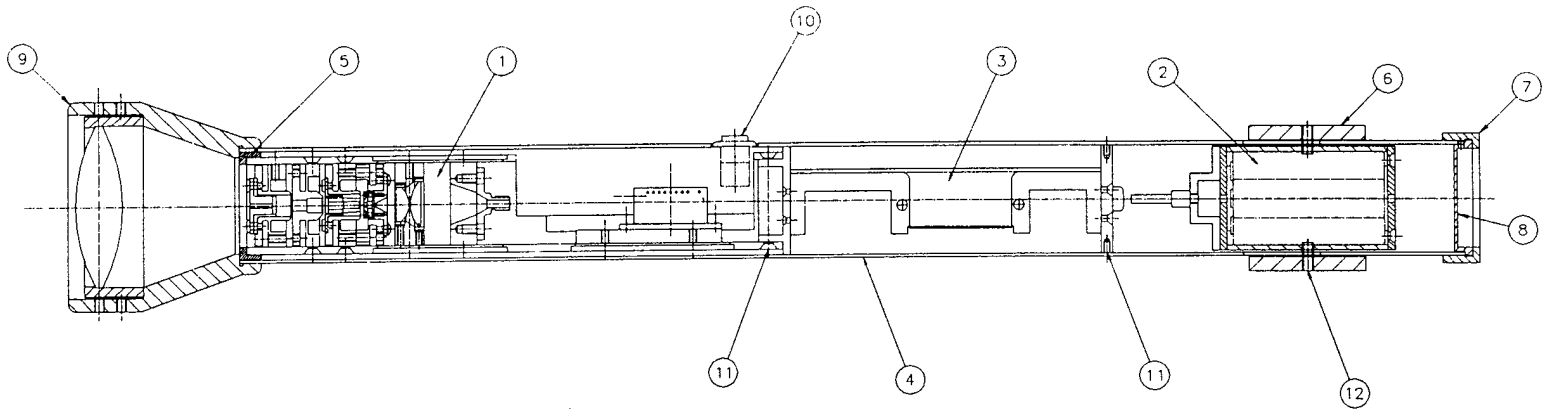
E-Mail: LBSYSTEMS®AGL.COM

REVISIONS					
LTR	DESCRIPTION	ECN	NAME	DATE	CHK



ITEM	QTY.	DESCRIPTION	PART NUMBER
12	2	SHSS, #10-32 X .50 LG	
11	11	FHCS, #6-32 X .25 LG	
10	1	PUSHBUTTON (NEWARK)	
9	1	ASSY, BEAM EXPANDER	33007-78
8	1	INSERT, PANEL, CONTROL	33007-71
7	1	CAP, END	33007-53
6	1	RING, SLIDE	33007-58
5	1	SPACER, RESONATOR	33007-49
4	1	HOUSING, OUTER	33007-48
3	1	ASSY, POWER SUPPLY	33007-03
2	1	ASSY, BATTERY PACK	33007-02
1	1	ASSY, RESONATOR	33007-01

PARTS LIST

THIRD ANGLE PROJECTION

UNLESS OTHERWISE SPECIFIED
TOLERANCES
.XX = ±.010 FRACTIONS = ±1/64
.XXX = ±.005 ANGLES = 0°-30'
BREAK SHARP EDGES .005-.020
FILLET RADII .005-.020
DIMENSIONS ARE IN INCHES

DO NOT SCALE DWG.

MATERIAL XXX

FINISH XXX

	NAME	DATE
DRN		
DESG	L. BILLINGS	5/31/97
CHK		
APPR		

PROJ. NO. DAAE30-98-C-0070

MODEL XXX

L E Systems Inc.
CLINTON, CT 06413

TITLE ASSY, FLASHLIGHT

DWG NO. D-33007-00 REV -

SCALE FULL SHEET 1 OF 1

SAND97-2392C
Submitted for presentation at the Non-Lethal Defense III, February 24-26, 1998,
Johns Hopkins Applied Physics Laboratory, Laurel, MD

Next-Generation Diversionary Devices

Mark C. Grubelich, Susan H. Fischer, and Paul W. Cooper
Sandia National Laboratories
PO Box 5800, MS-1453
Albuquerque, NM 87185-1453

ABSTRACT

Diversionary devices are of use in a wide variety of military and law-enforcement operations. They function to distract and/or incapacitate adversaries in scenarios ranging from hostage rescue to covert strategic paralysis operations.

The current Mk141 diversionary device (also known as "flash bang" or "stun grenade") is used in military and law enforcement operations. The desired results of the Mk141 are to produce a disorienting flash of light and a shock wave to temporarily incapacitate or disorient adversaries without inflicting permanent damage.

There are several disadvantages to using the Mk141. The energetic material used in the Mk141 is classed as a 1.1 explosive, making storage, transportation, and manufacture difficult. The energetic material produces a high point-source pressure (on the order of 5 ksi at the surface of the device) in order to produce the desired far-field diversionary effects. Consequently the Mk141 can produce serious injuries and fatalities in the near-field. Furthermore, smoke produced by the device hinders target acquisition.

We have been developing a next generation diversionary device to satisfy the requirements of the less-than-lethal criteria. Less-than-lethal requires the incapacitation of personnel while minimizing fatalities, permanent injury, and unplanned collateral damage. This next-generation device is capable of producing the desired far-field diversionary effects without high near-field pressures. This device also exhibits reduced smoke production which allows for easier target acquisition

We have demonstrated proof-of-concept of the next-generation diversionary device. The next step will be to develop a prototype device.

Designated points of contact for this work are Mark Grubelich, (505) 844-9052, mcgrube@sandia.gov and Susan Fischer, (505) 845-8092, shfisch@sandia.gov.

Next-Generation Diversionary Devices

Mark C. Grubelich, Susan H. Fischer, and Paul W. Cooper
Sandia National Laboratories
PO Box 5800, MS-1453
Albuquerque, NM 87185-1453

INTRODUCTION

Diversionary devices are used in a wide variety of military and law-enforcement operations. They function to distract and/or incapacitate adversaries in scenarios ranging from hostage rescue to covert strategic paralysis operations.

There are a number of disadvantages associated with currently available diversionary devices. Personnel safety is of paramount importance as serious injuries and fatalities have resulted from their use both operationally and in training .

Desired improvements to these devices include protection against inadvertent initiation, lower smoke production, the elimination of the production of high-velocity fragments, and increased light output.

We have been developing a next-generation diversionary flash-bang device that would provide increased safety, lower smoke production, no secondary high-velocity fragments, higher light output, and the potential for user-tailorable output.

BACKGROUND

In the United States, the first diversionary devices used were M116A1 hand-grenade simulators. The M116A1 used a pull-wire fuze lighter and a piece of time-delay blasting fuze that provided a delay of 15 to 30 seconds. This device contained 35 grams of a photoflash mix.

The FBI Hostage Rescue Team modified the M116A1. An M301 fuze assembly, used in smoke grenades, was employed to provide a shorter (two-to-four-second) delay. This was done by removing the pull-wire fuze lighter and delay fuze. The M301 fuze was installed in the cardboard body of the M116A1; a potting compound was used to seal the assembly. Problems associated with these devices included occasional flashthroughs in the fuze assembly (leading to "instantaneous" functioning), fuze function failures, the ejection of the fuze at potentially lethal velocities ranging from 80 fps to 180 fps, fires as a result of smoldering cardboard body fragments, and excessive smoke production.

As a result of the US military's requirement for an next-generation operational device, Sandia National Laboratories was asked to design a device addressing these problems. The new device,

the Mk141 mod 0 device, contained 17.5 grams of flake aluminum and potassium perchlorate flash powder. Less smoke was produced due to the decrease in the amount of material in the charge as well as better combustion efficiency. The design had a molded plastic fuze assembly which eliminated flash-through problems. It was ejected at a low velocity (~20 fps) prior to the ignition of the flash powder. This was accomplished by igniting a small pyrotechnic charge which separated the fuze assembly from the Mk141's main body. A short delay column, integral to the main body, subsequently ignited the flash-powder charge which functioned within approximately a foot of where it was thrown. The body was made of fire-retardant urethane foam to eliminate any high-velocity high-density fragments and to reduce the probability of secondary fires. The body was colored black for covert operations.

The original M116A1, the modified M116A1, and the Mk141 are pictured in Figure 1. Figure 2 shows a disassembled Mk141.

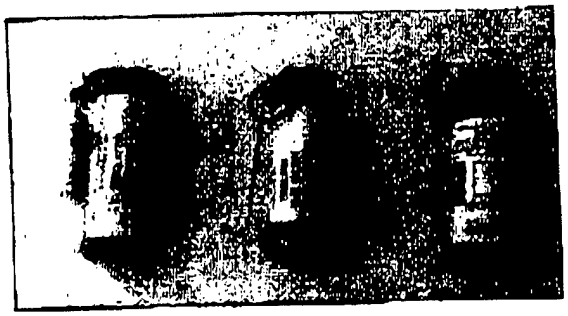


Figure 1. M116A1 mod 0, M116A1 mod 1, and Mk141.

Figure 2. Disassembled Mk141.

PERFORMANCE OF THE Mk141

The Mk141 produces an internal pressure of about 27 ksi with a rapid rise to the peak pressure, as is shown in Figure 3. This peak side-on pressure decays with distance as is shown in Figure 4. This overpressure, combined with intense light output (which has never been characterized), temporarily distracts and/or incapacitates adversaries.

Unfortunately, the contact and very near-field effects of the Mk141 are of sufficient magnitude to cause permanent injuries and/or fatalities due to the overpressure as well as high-velocity secondary fragments. The degree of injury depends on peak pressure and the duration of the overpressure wave.

Survival curves have been compiled for a number of conditions. Figures 5, 6, and 7 show these curves for several orientations of the subject with respect to the shock wave. The damage thresholds also depend on the presence or absence of a reflecting surface close to the subject. This effect is illustrated by comparing Figures 6 and 7. Similar curves are available for ear damage. The threshold for eardrum rupture is about 4 psi.

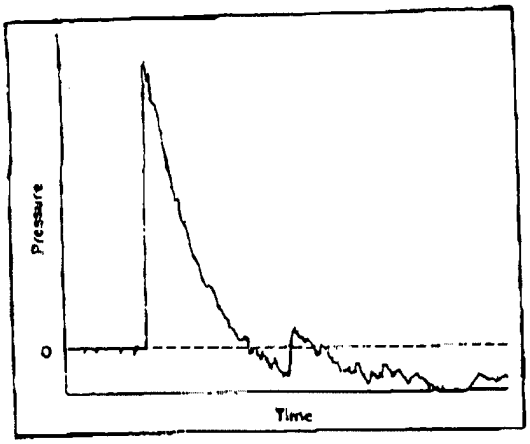


Figure 3. Typical pressure trace for the Mk141.

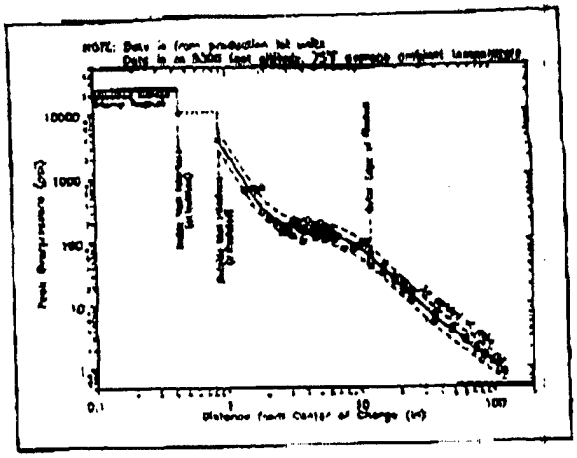


Figure 4. Pressure vs distance data for the Mk141.

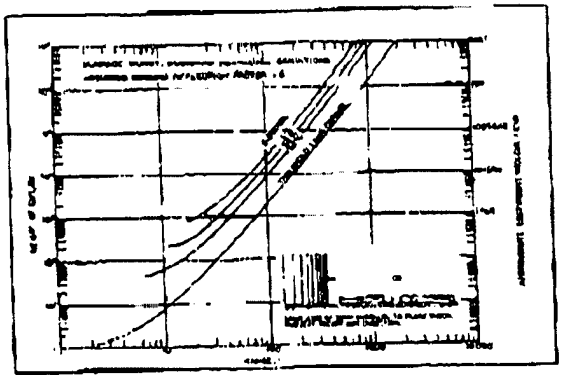


Figure 5. Predicted survival curves for man exposed in the free stream to surface burst of TNT where the long axis of the body is parallel to the blast winds.

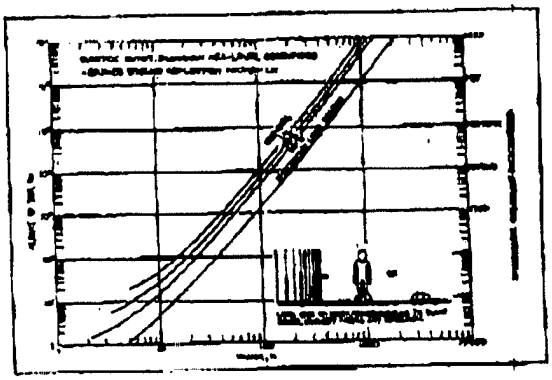


Figure 6. Predicted survival curves for man exposed in the free stream to surface bursts of TNT where the long axis of the body is perpendicular to the blast winds.

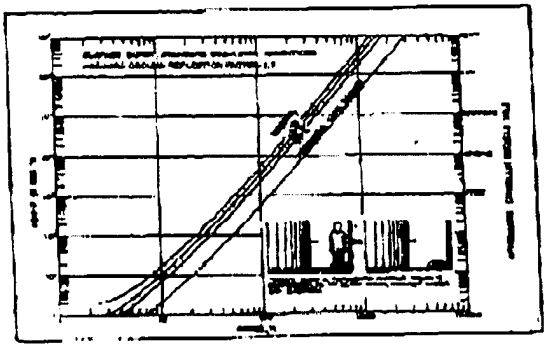


Figure 7. Predicted survival curve for man exposed to surface bursts of TNT where the thorax is near a flat rigid surface reflecting the blast wave at normal incidence.

Other safety concerns also exist. The Mk141 utilizes a "flash powder" mix of potassium perchlorate and aluminum which is a class 1.1 explosive. This material is sensitive to shock, thermal, electrostatic, and mechanical ignition stimuli. These devices are also susceptible to sympathetic detonation and initiation by bullet impact. Additionally, the Mk141 device must be handled as a destructive device during storage and shipping as it is, effectively, a small bomb.

NEXT-GENERATION FLASH-BANG DIVERSIONARY DEVICE

General Description

Based on recent research, coupled with the desire for an improvement in safety, a safer and more versatile diversionary device can be developed using the combustion of a fuel delivered by the

device and the oxygen present in the ambient air. This next-generation device ejects a powdered fuel that mixes with ambient air and then auto-ignites. (This process is similar to the ignition of propellant gases in guns resulting in a "muzzle flash" event or the ignition of dust in a grain-elevator explosion). The operation of this device produces a fuel-air combustion reaction. Since a combustion process is more spatially and temporally diffuse than the detonation of an explosive, a longer pressure pulse with a slower rise to the peak pressure results. This produces a near-field peak overpressure that is several orders of magnitude lower than that of the Mk141. The desired far-field effects of acoustic and visual alarm are preserved.

Advantages

There are many advantages of this next-generation flash-bang device.

- Due to the reduced near-field peak overpressure, the possibility of permanent damage to subjects exposed to the near-field pressure wave would be greatly reduced.
- The acceleration of any near-field objects produced by the overpressure would be less, making serious injury due to secondary high-velocity fragments much less likely.
- The nonexplosive nature of the powdered-metal fill would allow the devices to be stored and shipped with fewer (if any) restrictions.
- The fuel-air reaction will produce less smoke since the products of combustion would not contain potassium chloride. Thus, target acquisition upon entry would be enhanced.
- The next-generation diversionary device's "yield" could be customized in the field. The acoustic and light output could be adjustable by increase or decrease of the fuel charge during each particular operational scenario.

Metal Powder Fuels

For the next-generation diversionary flash-bang device discussed here, aluminum was selected for the fuel. Fine aluminum particles have high reactivity in air and good combustion efficiency without being pyrophoric. This is accomplished commercially by passivating even submicron aluminum particles to produce a thin inert aluminum-oxide layer while still allowing the underlying aluminum to remain active.

EXPERIMENTAL CHARACTERIZATION

In preliminary tests, we have demonstrated proof-of-concept of the next-generation diversionary device. This was accomplished by expelling twenty-five grams of 3μ aluminum powder (Valimet H3) from a one-inch inside-diameter by six-inch-long tube with 2.5 grams of 4Fg black powder (used as a gas generator and igniter charge). The residual hot gases and particles from the black powder ignite the aluminum powder as it mixes with air.

The experimental setup is illustrated in Figure 8. The test configuration allows the aluminum powder to be launched vertically resulting in a very directional output. This potentially allows for next-generation coupling to the target.

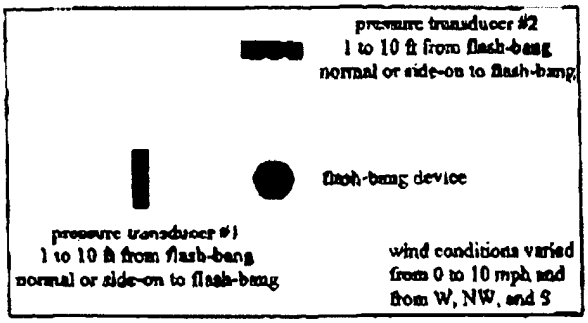


Figure 8. Experimental setup for pressure measurements of a next-generation flash-bang device.

The overpressure was measured at distances from one to ten feet from the device. We oriented the pressure transducers to measure the total (reflected) as well as side-on overpressure. A pressure trace from these preliminary tests is shown in Figure 9. As was seen in Figure 3, the Mk141 produces a shock wave with a rapid ("instantaneous") rise to the peak pressure and an exponential decay. The pressure curve of the next-generation flash-bang device is markedly different. The pressure rise is much more gradual and the peak pressure is significantly lower. When the next-generation flash-bang device functions, a combustion wave rather than a detonation wave proceeds through the fuel-air mixture.

Figure 10 shows several stills from a videotape of one of these proof-of-concept test.